



NX3008NBK

30 V, 400 mA N-channel Trench MOSFET

Rev. 1 — 2 August 2011

Product data sheet

1. Product profile

1.1 General description

N-channel enhancement mode Field-Effect Transistor (FET) in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

1.2 Features and benefits

- Very fast switching
- Low threshold voltage
- Trench MOSFET technology
- ESD protection up to 2 kV
- AEC-Q101 qualified

1.3 Applications

- Relay driver
- High-speed line driver
- Low-side loadswitch
- Switching circuits

1.4 Quick reference data

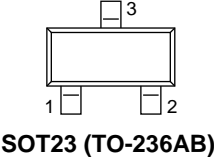
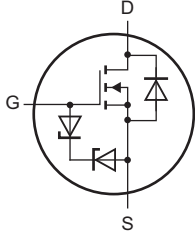
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|----------------------------------|---|-------|-----|-----|----------|
| V_{DS} | drain-source voltage | $T_j = 25\text{ °C}$ | - | - | 30 | V |
| V_{GS} | gate-source voltage | | -8 | - | 8 | V |
| I_D | drain current | $V_{GS} = 4.5\text{ V};$ $T_{amb} = 25\text{ °C}$ | [1] - | - | 400 | mA |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5\text{ V};$ $I_D = 350\text{ mA}; T_j = 25\text{ °C}$ | - | 1 | 1.4 | Ω |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm².

2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|---|--|
| 1 | G | gate |  <p>SOT23 (TO-236AB)</p> |  <p>017aaa255</p> |
| 2 | S | source | | |
| 3 | D | drain | | |

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|----------|--|---------|
| | Name | Description | Version |
| NX3008NBK | TO-236AB | plastic surface-mounted package; 3 leads | SOT23 |

4. Marking

Table 4. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| NX3008NBK | KS% |

[1] % = placeholder for manufacturing site code.

5. Limiting values

Table 5. Limiting values

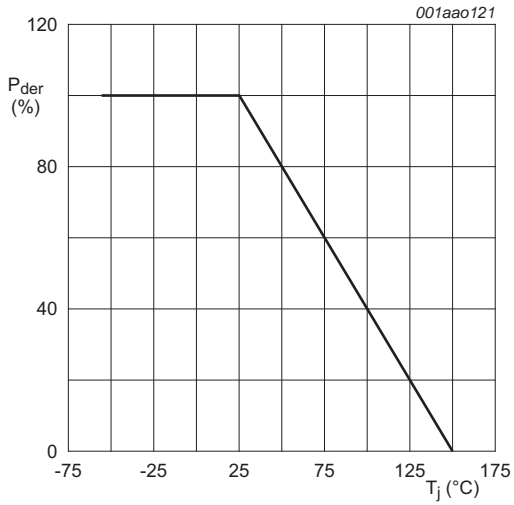
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit | |
|---------------------------|---------------------------------|--|-----|-----|------|----|
| V_{DS} | drain-source voltage | $T_j = 25\text{ °C}$ | - | 30 | V | |
| V_{GS} | gate-source voltage | | -8 | 8 | V | |
| I_D | drain current | $V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ °C}$ | [1] | - | 400 | mA |
| | | $V_{GS} = 4.5\text{ V}; T_{amb} = 100\text{ °C}$ | [1] | - | 250 | mA |
| I_{DM} | peak drain current | $T_{amb} = 25\text{ °C};$ single pulse; $t_p \leq 10\text{ }\mu\text{s}$ | - | 1.6 | A | |
| P_{tot} | total power dissipation | $T_{amb} = 25\text{ °C}$ | [2] | - | 350 | mW |
| | | | [1] | - | 420 | mW |
| | | $T_{sp} = 25\text{ °C}$ | - | - | 1140 | mW |
| T_j | junction temperature | | -55 | 150 | °C | |
| T_{amb} | ambient temperature | | -55 | 150 | °C | |
| T_{stg} | storage temperature | | -65 | 150 | °C | |
| Source-drain diode | | | | | | |
| I_S | source current | $T_{amb} = 25\text{ °C}$ | [1] | - | 400 | mA |
| ESD maximum rating | | | | | | |
| V_{ESD} | electrostatic discharge voltage | HBM | [3] | - | 2000 | V |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm².

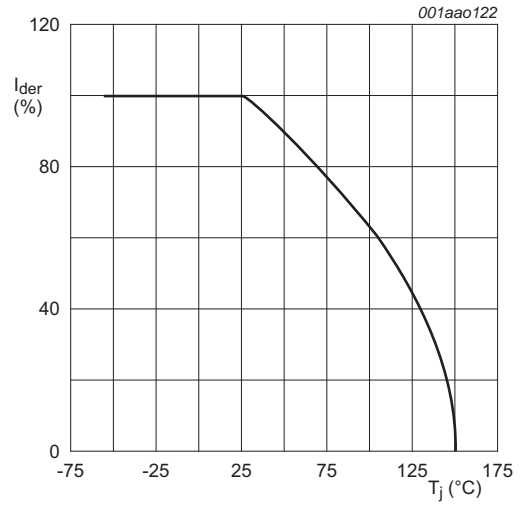
[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[3] Measured between all pins.



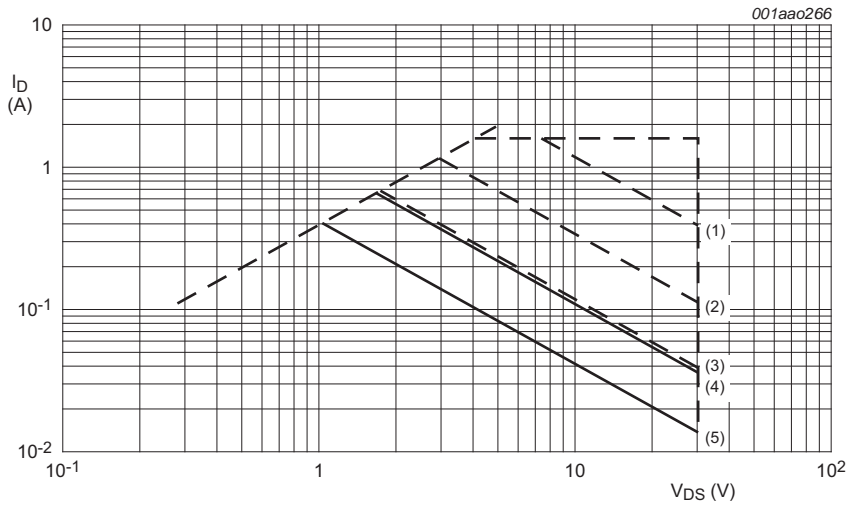
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100\%$$

Fig 1. Normalized total power dissipation as a function of junction temperature



$$I_{der} = \frac{I_D}{I_{D(25^{\circ}\text{C})}} \times 100\%$$

Fig 2. Normalized continuous drain current as a function of junction temperature



I_{DM} is a single pulse

- (1) $t_p = 1 \text{ ms}$
- (2) $t_p = 10 \text{ ms}$
- (3) $t_p = 100 \text{ ms}$
- (4) DC; $T_{sp} = 25 \text{ }^{\circ}\text{C}$
- (5) DC; $T_{amb} = 25 \text{ }^{\circ}\text{C}$; 1 cm^2 drain mounting pad

Fig 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

6. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|----------------|--|-------------|-----|-----|-----|------|-----|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | 310 | 370 | K/W |
| | | | [2] | - | 260 | 300 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | - | - | 115 | K/W | |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm².

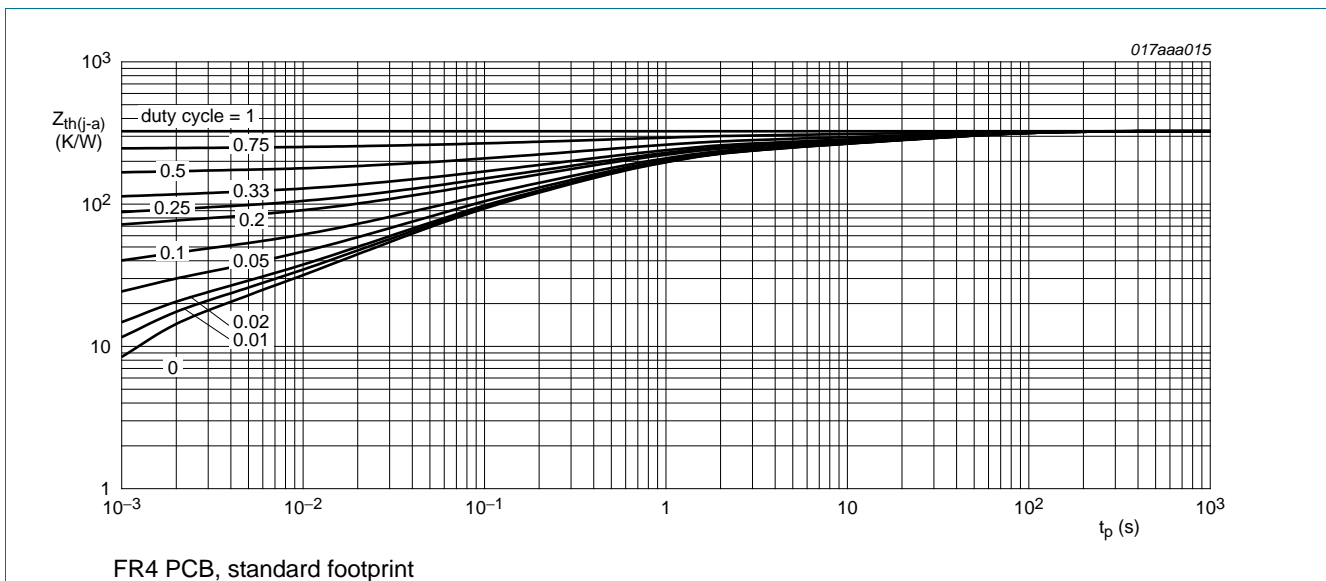


Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

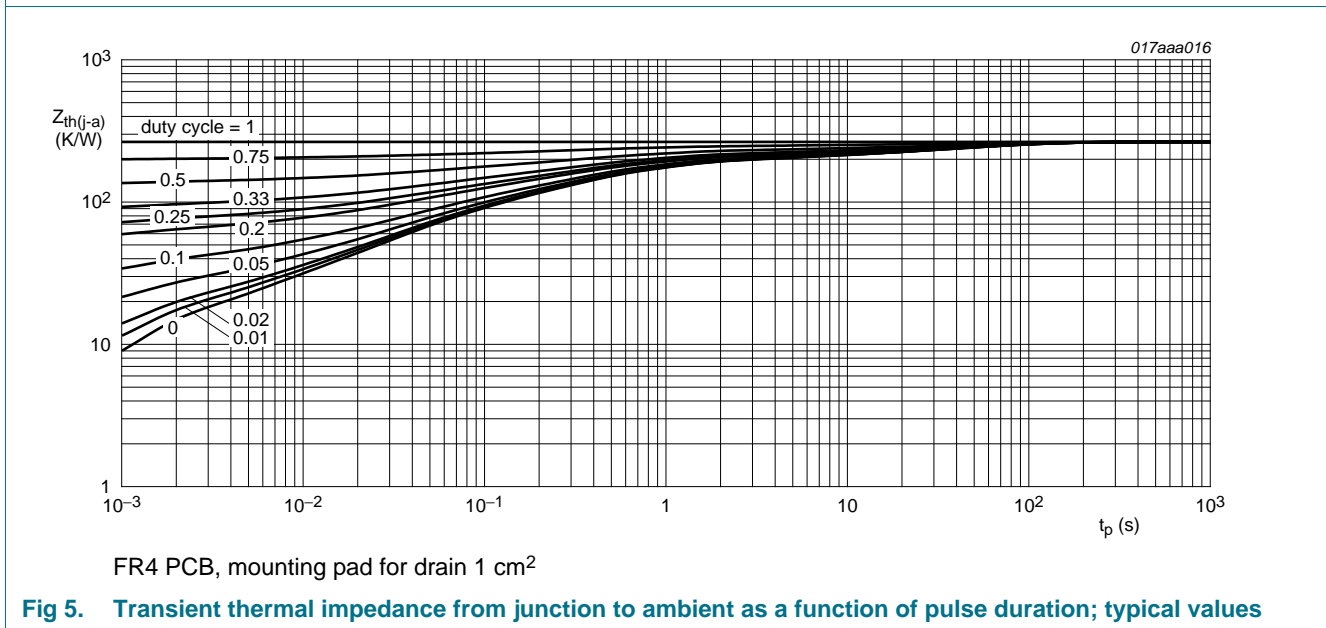


Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

7. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|--|------|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu\text{A}$; $V_{GS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | 30 | - | - | V |
| V_{GSth} | gate-source threshold voltage | $I_D = 250 \mu\text{A}$; $V_{DS} = V_{GS}$; $T_j = 25 \text{ }^\circ\text{C}$ | 0.6 | 0.9 | 1.1 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 30 \text{ V}$; $V_{GS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | - | 1 | μA |
| | | $V_{DS} = 30 \text{ V}$; $V_{GS} = 0 \text{ V}$; $T_j = 150 \text{ }^\circ\text{C}$ | - | - | 10 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 8 \text{ V}$; $V_{DS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 0.2 | 1 | μA |
| | | $V_{GS} = -8 \text{ V}$; $V_{DS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 0.2 | 1 | μA |
| | | $V_{GS} = 4.5 \text{ V}$; $V_{DS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 10 | - | nA |
| | | $V_{GS} = -4.5 \text{ V}$; $V_{DS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 10 | - | nA |
| | | $V_{GS} = 2.5 \text{ V}$; $V_{DS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 1 | - | nA |
| | | $V_{GS} = -2.5 \text{ V}$; $V_{DS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 1 | - | nA |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = 4.5 \text{ V}$; $I_D = 350 \text{ mA}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 1 | 1.4 | Ω |
| | | $V_{GS} = 4.5 \text{ V}$; $I_D = 350 \text{ mA}$; $T_j = 150 \text{ }^\circ\text{C}$ | - | 1.8 | 2.5 | Ω |
| | | $V_{GS} = 2.5 \text{ V}$; $I_D = 200 \text{ mA}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 1.4 | 2.1 | Ω |
| | | $V_{GS} = 1.8 \text{ V}$; $I_D = 10 \text{ mA}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 2.8 | Ω |
| g_{fs} | forward transconductance | $V_{DS} = 10 \text{ V}$; $I_D = 350 \text{ mA}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 310 | - | mS |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $V_{DS} = 15 \text{ V}$; $I_D = 400 \text{ mA}$; $V_{GS} = 4.5 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 0.52 | 0.68 | nC |
| Q_{GS} | gate-source charge | | - | 0.17 | - | nC |
| Q_{GD} | gate-drain charge | | - | 0.08 | - | nC |
| C_{iss} | input capacitance | $V_{DS} = 15 \text{ V}$; $f = 1 \text{ MHz}$; $V_{GS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 34 | 50 | pF |
| C_{oss} | output capacitance | | - | 6.5 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 2.2 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 20 \text{ V}$; $R_L = 250 \Omega$; $V_{GS} = 4.5 \text{ V}$; $R_{G(ext)} = 6 \Omega$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 15 | 30 | ns |
| t_r | rise time | | - | 11 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 69 | 138 | ns |
| t_f | fall time | | - | 19 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 350 \text{ mA}$; $V_{GS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | 0.47 | 0.85 | 1.2 | V |

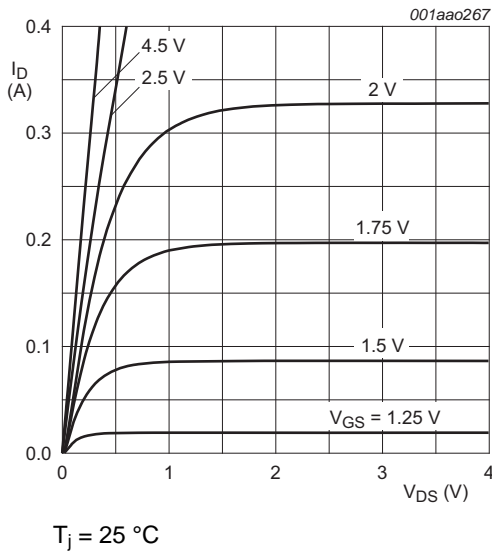


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

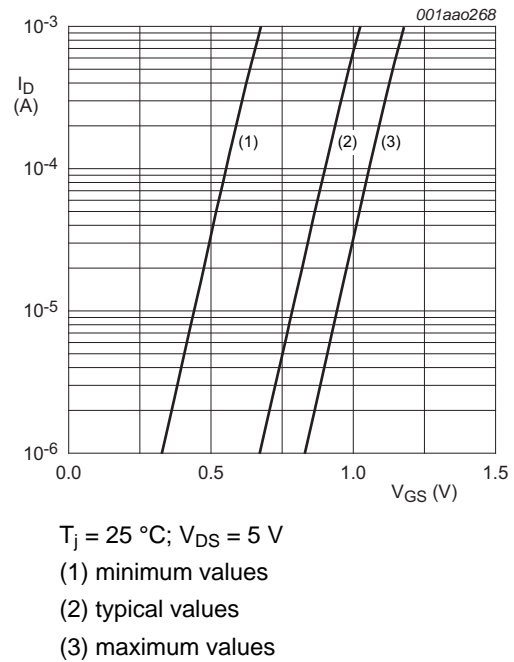


Fig 7. Sub-threshold drain current as a function of gate-source voltage

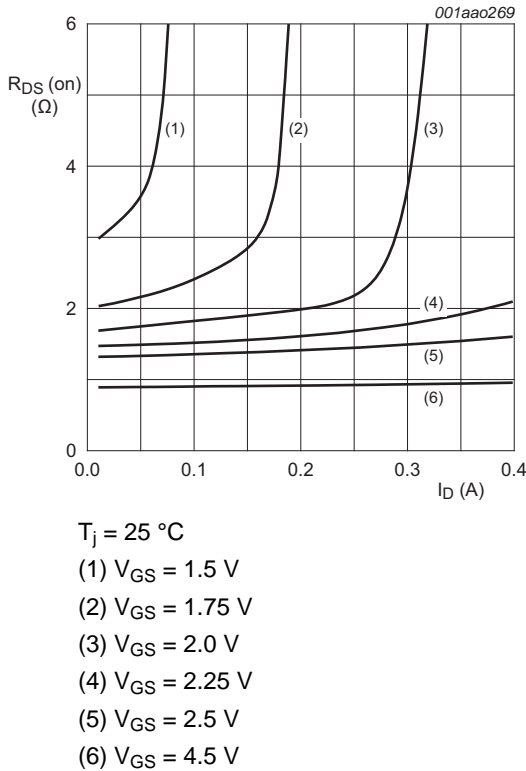


Fig 8. Drain-source on-state resistance as a function of drain current; typical values

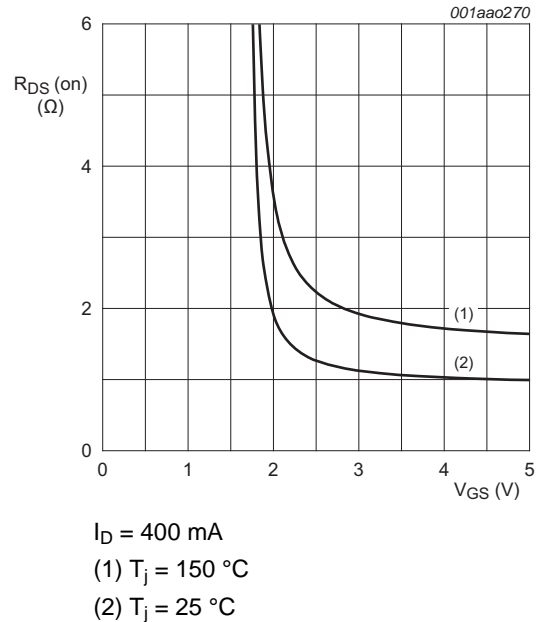
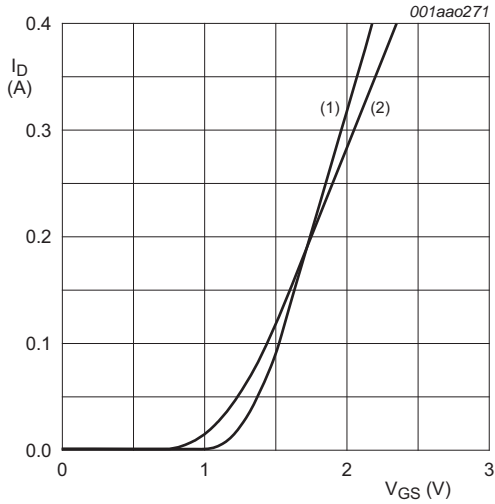
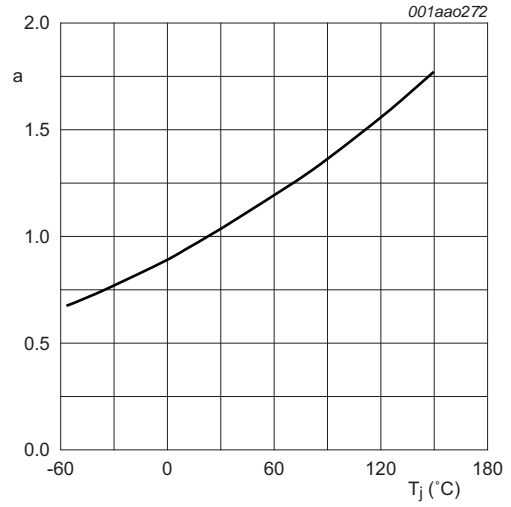


Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



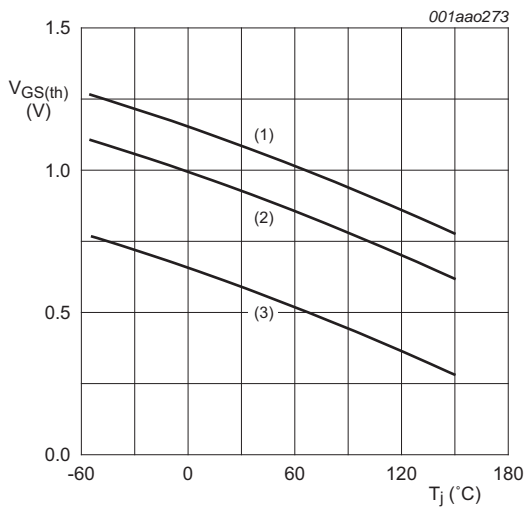
$V_{DS} > I_D \times R_{DS(on)}$
 (1) $T_j = 25\text{ °C}$
 (2) $T_j = 150\text{ °C}$

Fig 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values



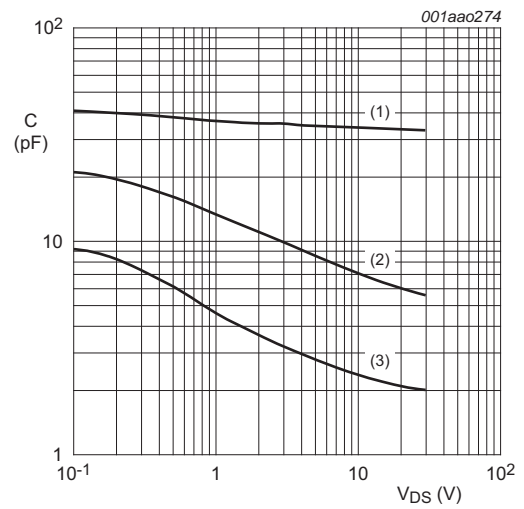
$$a = \frac{R_{DS(on)}}{R_{DS(on)@25^\circ\text{C}}}$$

Fig 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values



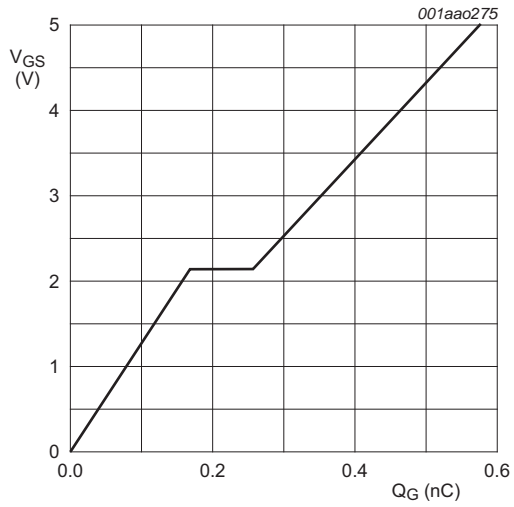
$I_D = 0.25\text{ mA}; V_{DS} = V_{GS}$
 (1) maximum values
 (2) typical values
 (3) minimum values

Fig 12. Gate-source threshold voltage as a function of junction temperature



$f = 1\text{ MHz}; V_{GS} = 0\text{ V}$
 (1) C_{iss}
 (2) C_{oss}
 (3) C_{rss}

Fig 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$I_D = 0.4$ A; $V_{DS} = 15$ V; $T_{amb} = 25$ °C

Fig 14. Gate-source voltage as a function of gate charge; typical values

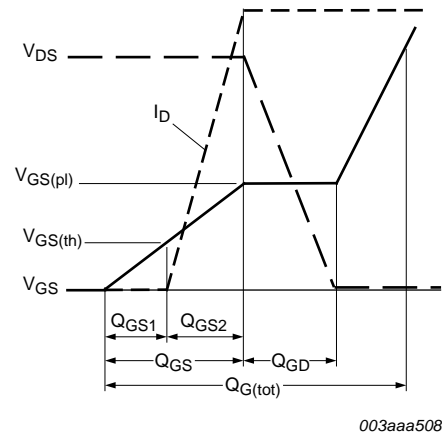
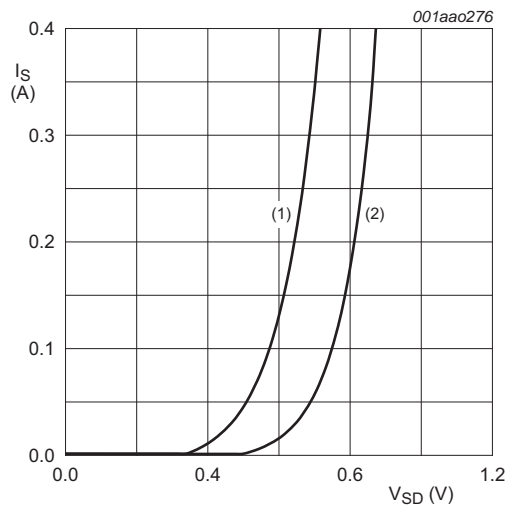


Fig 15. Gate charge waveform definitions



$V_{GS} = 0$ V
 (1) $T_j = 150$ °C
 (2) $T_j = 25$ °C

Fig 16. Source current as a function of source-drain voltage; typical values

8. Test information

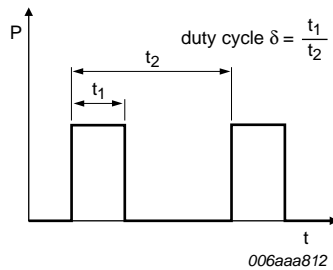


Fig 17. Duty cycle definition

8.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

9. Package outline

Plastic surface-mounted package; 3 leads

SOT23

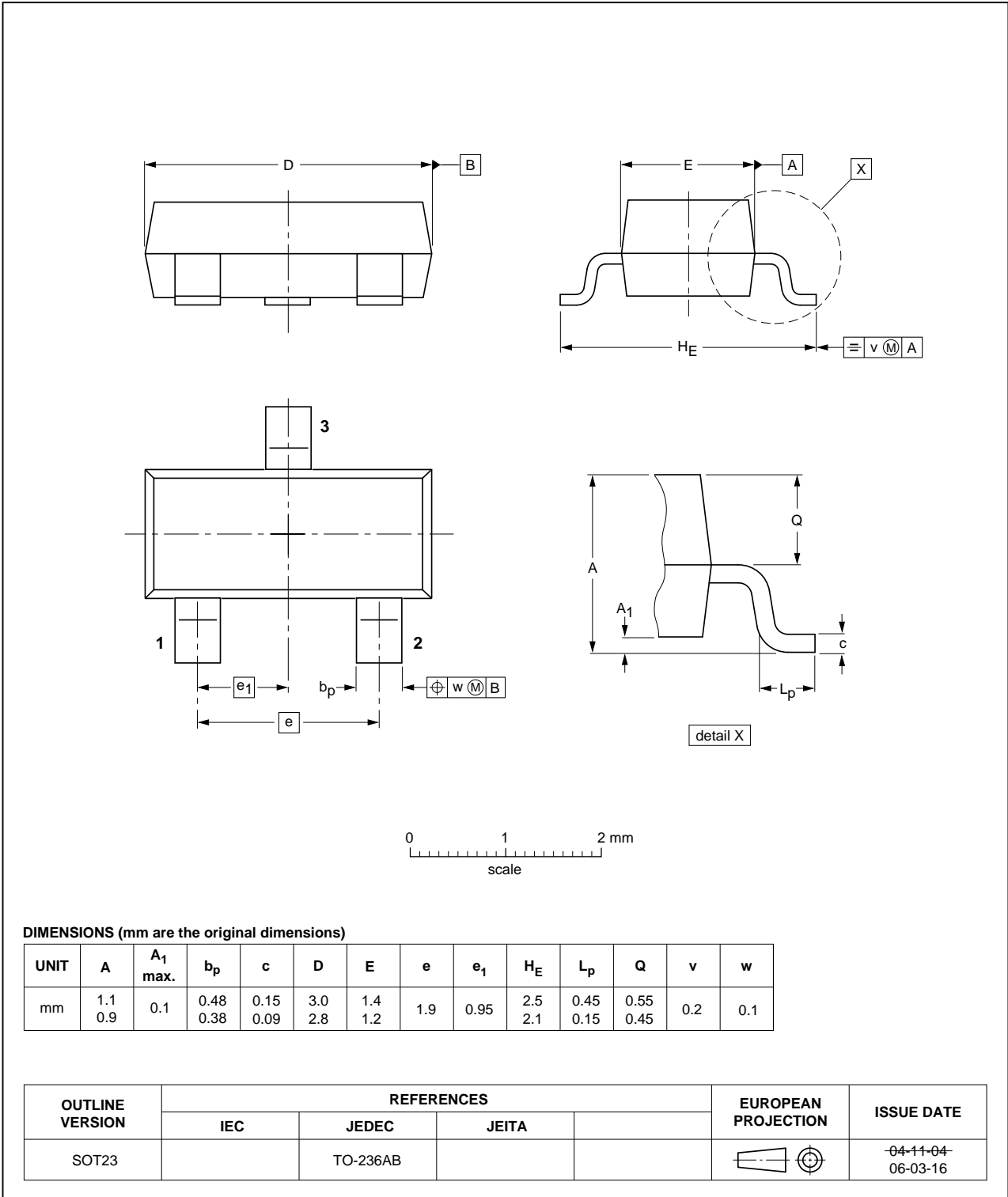


Fig 18. Package outline SOT23 (TO-236AB)

10. Soldering

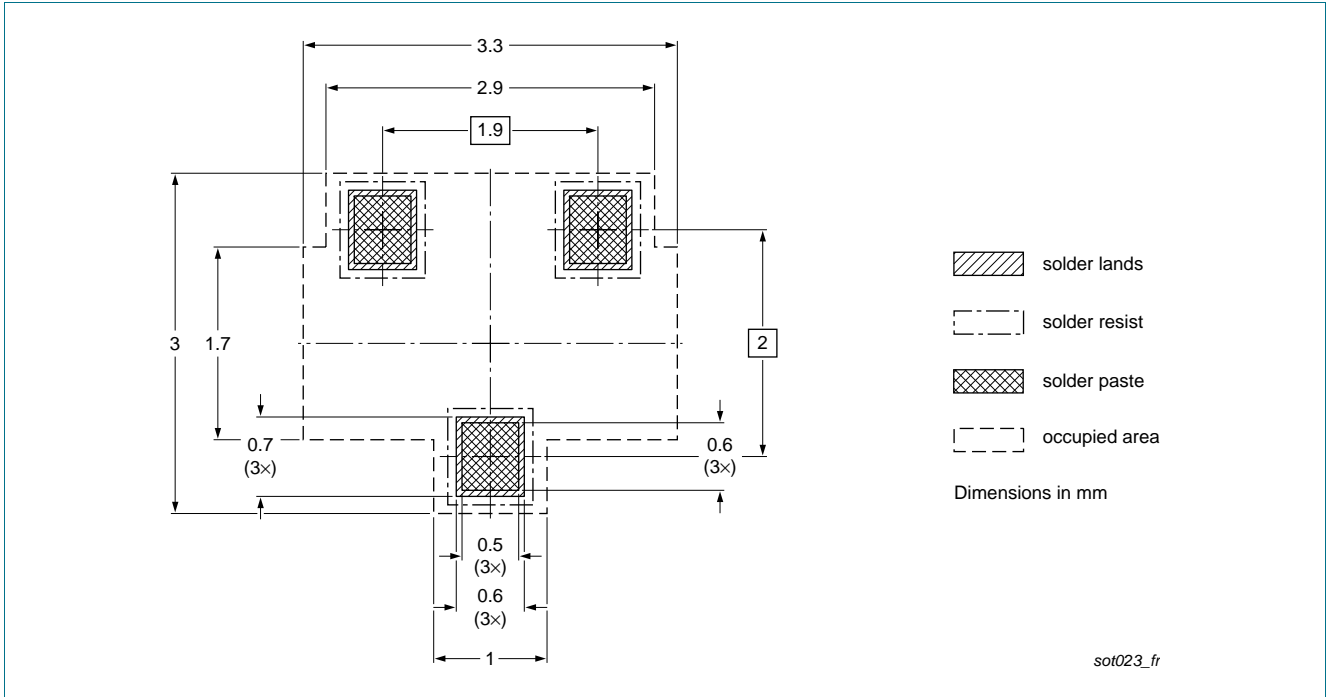


Fig 19. Reflow soldering footprint for SOT23 (TO-236AB)

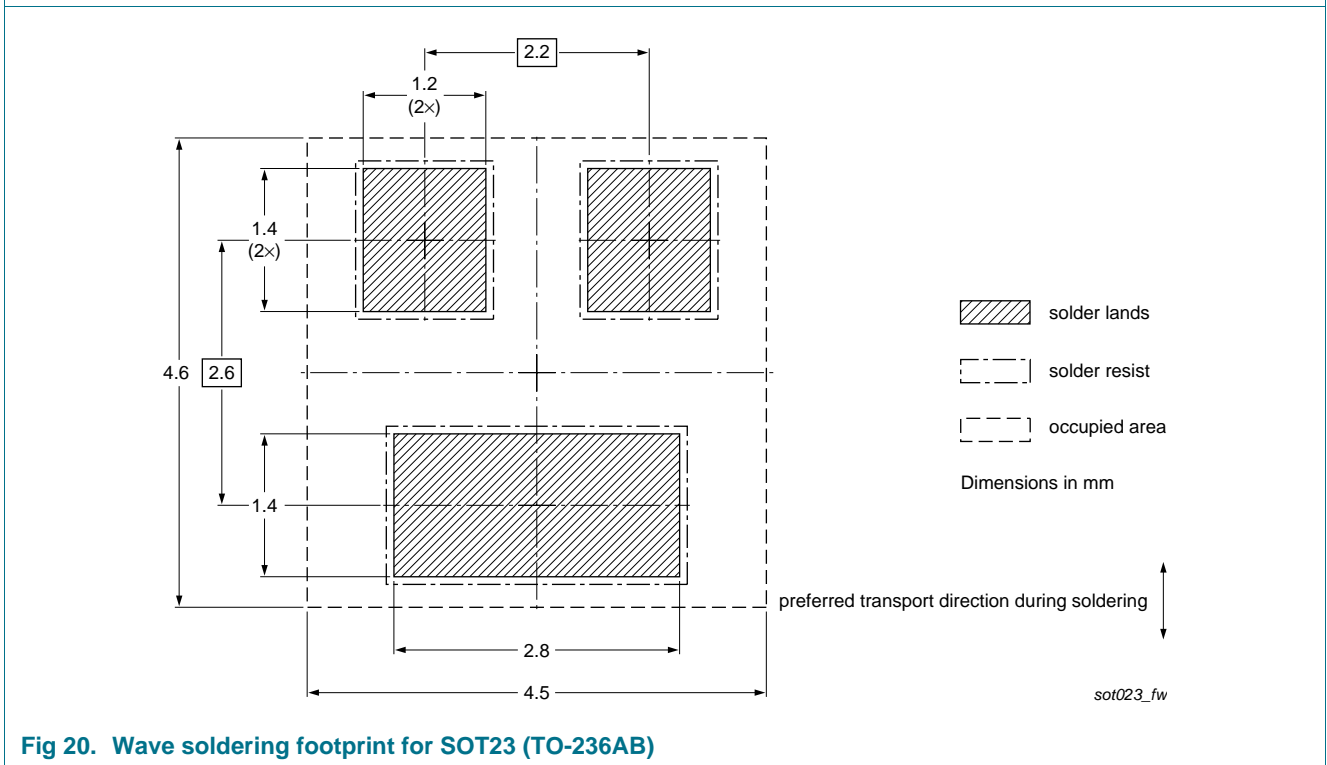


Fig 20. Wave soldering footprint for SOT23 (TO-236AB)

11. Revision history

Table 8. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| NX3008NBK v.1 | 20110802 | Product data sheet | - | - |

12. Legal information

12.1 Data sheet status

| Document status ^[1] ^[2] | Product status ^[3] | Definition |
|---|-------------------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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For sales office addresses, please send an email to: salesaddresses@nexperia.com

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